

What is claimed is:

1. A method for making amorphous spherical particles of zirconium titanate having tailored intraparticle nanostructures comprising the steps of:
  - a) preparing an aqueous solution of a zirconium salt;
  - b) preparing an aqueous solution of a titanium salt;
  - c) mixing said solution of zirconium salt with said solution of titanium salt into a mixed salt solution wherein said mixed salt solution has about equal moles of zirconium and titanium and wherein said mixed salt solution has a total salt concentration in the range from 0.01 M to about 0.5 M;
  - d) adding a stearic dispersant and an organic solvent to said mixed salt solution, subjecting said zirconium salt and said titanium salt in said mixed salt solution to a coprecipitation reaction to form a liquid solution containing amorphous spherical particles of zirconium titanate having tailored intraparticle nanostructures wherein the volume ratio of said organic solvent to aqueous part is in the range from 1 to 5.
2. A method for making fine or ultrafine crystalline spherical particles of zirconium titanate having tailored intraparticle nanostructures according to the steps of Claim 1, further comprising the step of incubating said liquid solution of step d) containing amorphous spherical particles of zirconium titanate in an oven at a temperature of less than or equal to 100°C for a period of time of less than or equal to 24 hours to convert said amorphous spherical particles of zirconium titanate to fine or ultrafine crystalline spherical particles of zirconium titanate wherein said salt concentration, said volume ratio of said organic solvent to aqueous part, said temperature of said oven and said incubation time are selected to produce said spherical particles having a desired size and tailored intraparticle nanostructure.
3. The method of Claim 1 wherein said zirconium salt is zirconyl chloride.
4. The method of Claim 1 wherein said titanium salt is titanium tetrachloride.
5. The method of Claim 1 wherein said stearic dispersant is hydroxypropylcellulose.
6. The method of Claim 5 wherein said concentration of said hydroxypropylcellulose is fixed at 0.002 g/cm<sup>3</sup>.

7. The method of Claim 2 wherein said incubation temperature is 100°C.
8. The method of Claim 2 wherein said oven is a microwave oven to induce rapid nucleation and growth of said spherical particles to produce nanosized spherical particles.
9. The method of Claim 8 wherein said incubation time in said microwave oven is from about 2 seconds to about 6 seconds.
10. The method of Claim 1 wherein said organic solvent is selected from the group consisting of methanol, ethanol, isopropanol, n-propanol, tert butyl alcohol, n-butanol, acetone and glycerol.
11. The method of Claim 10 wherein said organic solvent is isopropanol.